

TABLE H-1
SUB-BASINS OF 200 SQUARE MILES OR GREATER IN
THE KENTUCKY RIVER BASIN

<u>Sub-basins</u>	<u>Square Miles</u>
North Fork of Kentucky	1,883.0
South Fork of Kentucky	748.0
Middle Fork of Kentucky	559.0
Red River	487.00
Dix River	442.0
Elkhorn Creek (at lower Dam Site) Mile 2.5	492.0
Eagle Creek	519.0
Station Cam Creek	217.0

NOTE: This information is from the waste load allocation for Kentucky and is an output from the 303e River Basin Planning Effort.

TABLE H-2

COUNTY AREA IN THE KENTUCKY RIVER BASIN

County	Total Area (sq. miles)	Area in Basin (sq. miles)	County	Total Area (sq. miles)	Area in Basin (sq. miles)
Anderson	206	70	Lee	210	210
Bell	370	15	Leslie	409	409
Boyle	183	80	Letcher	339	290
Breathitt	494	494	Lincoln	340	187
Carroll	130	86	Madison	446	446
Clark	259	130	Menifee	210	65
Clay	474	430	Mercer	256	102
Estill	260	260	Montgomery	204	35
Fayette	280	280	Owen	351	351
Franklin	211	211	Owsley	197	197
Garrard	236	236	Perry	341	341
Grant	249	249	Powell	173	173
Harlan	469	70	Rockcastle	311	60
Henry	289	260	Scott	284	284
Jackson	337	135	Shelby	383	70
Jessamine	177	177	Trimble	146	60
Knott	356	255	Wolfe	227	227
Knox	373	38	Woodford	<u>193</u>	<u>193</u>
			Total		7,033

SOURCE: Rand McNally Standard Reference Map
and Guide of Kentucky, 1972.

TABLE H-3
SLOPES AND ELEVATIONS OF PRINCIPAL TRIBUTARIES
IN THE KENTUCKY RIVER BASIN

STREAM	LENGTH (Miles)	Max. El. (m.s.l.)	Min. El. (m.s.l.)	AVERAGE SLOPE (ft./miles)
N. Fork of Kentucky River	148.1	1,109	634	3.21
M. Fork of Kentucky River	43.3	757	627	3.00
S. Fork of Kentucky River	85.0	1,250	634	7.25
Goose Creek	21.8	830	754	3.49
Troublesome Creek	42.4	1,004	720	6.69
Red River	59.5	713	566	2.47
Otter Creek	13.1	880	566	23.97
Boone Creek	7.2	780	549	32.08
Silver Creek	39.2	936	531	10.33
Paint Lick Creek	32.0	920	531	12.16
Hickman Creek	31.5	910	514	12.57
Jessamine Creek	13.1	860	519	26.03
Clarks Run Creek	10.4	920	750	16.35
Dix River				
H.W. to mp 34.6	23.2	822	750	3.27
	0.0 slope from mp 34.60 to mouth including reservoir			
Glenns Creek	12.5	830	469	28.88
Elkhorn Creek	90.6	950	454	5.48
Drennon Creek	16.6	800	428	22.41
Stephens Creek	20.9	920	598	15.41
Clarks Creek	15.4	791	586	13.31
Eagle Creek	81.4	737	428	3.80
Little Eagle Creek	12.6	914	737	14.05

NOTE: This information is from the waste load allocation for Kentucky and is an output from the 303e River Basin Planning Effort.

TABLE H-5

LAKES IN THE KENTUCKY RIVER BASIN

Location	County	Surface Area (Acres)	Capacity Acre-Feet
Fishpond Lake	Letcher County	31	1,037
Taylor Fork Lake	Madison County	169	3,572
Corinth Lake	Grant County	96	1,612
Bullock Pen	Grant County	134	2,464
Elmer Davis Lake	Owen County	149	3,151
Pan Bowl Lake	Jackson County	98	1,298
Lexington Reservoirs	Fayette County	408	3,850
Mill Creek Lake	Wolfe County	41	1,049
Elk Lake	Owen County	207	2,654
Herrington Lake	Mercer County	2,940	230,500
Kentucky Utility Fly Ash Disposal	Carroll County	89	2,491
Lake Vega	Madison County	132	1,557
Boltz Lake	Grant County	<u>92</u>	<u>2,168</u>
Total	-----	4,586	257,403
<u>Federal</u>			
Buckhorn Lake	Leslie & Perry County	1,230	21,800
Carr Fork Lake	Knott County	<u>710</u>	<u>6,480</u>
Total	-----	1,940	28,280
Grand Total	-----	6,526	285,683

SOURCE: Kentucky Department for Natural Resources and Environmental Protection, Division of Water Resources.

Table H-6

POPULATION AND FACILITY GRANT STATUS IN THE KENTUCKY RIVER BASIN

County - Cities	Total Population	Population in Basin	Project Type	Comments
Anderson	9,358	2,000		
Bell	31,087	700		
Boyle	21,090	16,800		
Danville		12,400	Step 1	Pending
Junction City		1,046	Step 1	Pending
Breathitt	14,221	14,221		
Jackson		1,887	Step 1	Pending
Carroll	8,523	7,000		
Carrollton		3,884	Step 1	Pending
Clark	24,090	5,300		
Clay	18,481	16,800		
Manchester		1,664	Step 1	Pending
Estill	12,752	12,752		
Irvine-Ravenna		3,702	Step 1	Pending
Fayette	174,323	174,323		
Lexington-Main		73,500	Step 1	
Lexington-West Hickman		43,500	Step 1	
Franklin	34,481	34,481		
Frankfort		22,700		
Garrard	9,457	9,457		
Lancaster		3,230	Step 1	
Grant	9,999	7,700		
Williamstown		2,063	Step 1	
Dry Ridge		1,100	Step 11	No Sewers
Harlan	37,370	3,800		
Henry	10,910	7,200		
New Castle		755	Step 1	
Pleasureville		747	Step 1	Pending, No Sewers
Jackson	10,005	3,900		
Jessamine	17,430	17,430		
Nicholasville		5,829	Step 1	Pending
Wilmore		3,466		No Planning

TABLE H-6 (continued)

County - Cities	Total Population	Population in Basin	Project Type	Comments
Knott Hindman	14,698	10,800 808	Step 1	Pending
Knox	23,689	1,800		
Lee Beattyville	6,587	6,587 923	Step 1	Pending
Leslie Hyden	11,623	11,623 482		No Planning
Letcher Whitesburg Neon-Fleming	23,165	17,900 1,137 1,178	Step 1 Step 1	Pending No Sewers
Lincoln Stanford Crab Orchard Hustonville	16,633	10,900 2,474 861 413	Step 1 Step 1 Step 1	No Sewers No Sewers
Madison Berea #1 Berea #2 Richmond #1 Richmond #2	42,730	42,730 4,600 2,300 10,100 7,700	Step 1 Step 1 Step 1 Step 1	Pending Pending Pending Pending
Menifee	1,100			
Mercer Burgin	15,960	3,700 1,002	Step 1	Pending-No Sewers
Montgomery	15,364	1,700		
Owen Owenton	7,470	7,470 1,280		No Planning
Owsley Booneville	5,023	5,023 126		No Planning
Perry Hazard Vicco	26,259	26,259 5,459 377	Step 1	No Planning Pending
Powell Stanton Clay City	7,704	7,704 2,037 938	Step 1 Step 1	Pending Pending
Rockcastle Brodhead	12,305	2,700 769		No Planning

TABLE H-6 (continued)

County - Cities	Total Population	Population in Basin	Project Type	Comments
Scott	17,948	17,948		
Georgetown		8,629	Step 1	Pending
Stamping Ground		411	Step III	No Sewers
Sadieville		272		No Planning-No Sewer:
Shelby	18,999	2,600		
Trimble	5,349	1,900		
Wolfe	5,669	5,669		
Campton		419	Step 1	Pending
Woodford	14,434	14,434		
Versailles		5,679	Step III	Step 1 Pending
Midway		1,278	Step 1	Pending

Source: Kentucky Department for Natural Resources and Environmental
Protection, Division of Water Quality.

TABLE H-7

Organic Loads Affecting Streams in the Kentucky River Basin

Length of streams to which treated organic loads are discharged	868
Stream length for which dissolved oxygen is predicted to be below 5 mg/l during periods of low flow	150
Stream length for which dissolved oxygen is predicted to be below 5 mg/l during periods of low flow due to	
Municipal Discharges	124
Industrial Discharges	---
Other Discharges	26

NOTE: This information is from the waste load allocation for Kentucky and is an output from the 303e river basin planning effort. The values indicated the stream miles in which the dissolved oxygen is predicted to be less than 5 mg.l when the stream flow is less than the once in ten year, seven day, low flow.

Table H-8

LOCKS AND DAMS ON THE KENTUCKY RIVER

Lock No.	Miles Above Mouth	Length of Pool Above Dam (miles)
1	4.0	27.0
2	31.0	11.0
3	42.0	23.0
4	65.0	17.2
5	82.2	14.0
6	96.2	20.8
7	117.0	22.9
8	139.9	17.6
9	157.5	18.9
10	176.4	24.6
11	201.0	19.9
12	220.9	19.0
13	239.9	9.1
14	249.0	-

Navigation Charts
U. S. Army Corps of Engineers
Louisville District

Table H-9

Water Quality Data for Kentucky River Basin

Station	#Obs.	Mean	S	Max.	Min.	Beg. Date	End Date
pH Specific Units, Kentucky (Ky. Std.) 6 to 9							
N. Fk. Kentucky R. at Hazard	276	7.2	0.7	9.5	3.8	10-62	6-74
	32	7.4	1.0	9.5	4.4	1-73	6-74
Red R. at Pine Ridge	49	7.2	0.3	7.9	6.7	4-69	7-74
	17	7.4	0.4	7.9	6.7	1-73	7-74
Ky. River, Lock 4 at Frankfort	285	7.5	0.4	8.4	6.2	10-59	9-73
	14	7.6	0.4	8.1	6.9	1-73	9-73
Eagle Creek at Glencoe	42	7.5	0.4	8.2	5.2	1-62	7-74
	16	7.5	0.7	8.2	5.2	2-73	7-74
Conductivity Micromhos, Ky. Std. 800 micro mhos							
N. Fk. Kentucky R. at Hazard	310	460	360	3,860	21.4	10-62	6-74
	34	620	880	3,860	21.4	1-73	6-74
Red R. at Pine Ridge	54	110	60	390	58	4-69	11-74
	22	120	90	390	58	1-73	11-74
Ky. River, Lock 4 at Frankfort	376	250	100	675	76	10-59	6-74
	17	230	50	320	145	1-73	6-74
Eagle Creek at Glencoe	49	350	120	617	17	1-62	11-74
	23	350	150	617	17	2-73	11-74
Dissolved Solids - Milligrams per liter (mg/l) Ky. Std. 500 micro mhos							
N. Fk. Kentucky R. at Hazard	15	570	630	2,190	21	10-68	4-74
	10	610	780	2,190	21	3-74	4-74
Red River at Pine Ridge	50	68	34	211	38	4-69	11-74
	18	78	53	211	38	1-73	11-74
Ky. River, Lock 4 at Frankfort	5	330	37	372	279	12-68	10-72
Eagle Creek at Glencoe	46	210	70	364	27	8-70	11-74
	23	210	90	364	27	2-73	11-74
Alkalinity mg/l, No Standard							
N. Fk. Kentucky R. at Hazard	177	55	42	205	0	11-64	6-74
	32	82	71	205	0	1-73	6-74
Red R. at Pine Ridge	53	32	31	193	9	4-69	11-74
	21	40	46	193	9	1-73	11-74
Ky. River, Lock 4 at Frankfort	218	65	19	128	16	10-59	9-73
	14	67	19	92	34	1-73	9-73
Eagle Creek at Glencoe	47	140	44	217	7	8-70	11-74
	23	140	56	217	7	2-73	11-74

Table H-9

Station	#Obs.	Mean	S	Max.	Min.	Beg. Date	End Date
Hardness mg/l, 0-60 soft, 61-120 moderately hard, 121-180 hard, over 180 very hard							
N. Fk. Kentucky R. at Hazard	267	160	110	726	5	10-62	4-74
Red River at Pine Ridge	30	190	180	710	5	1-73	4-74
	50	47	34	180	18	4-69	11-74
	18	59	54	180	18	1-73	11-74
Ky. River, Lock 4 at Frankfort	370	99	29	192	21	10-59	9-73
	14	100	23	140	63	1-73	9-73
Eagle Creek at Glencoe	49	180	63	300	8	1-62	11-74
	23	180	80	300	8	2-73	11-74
Color - Platinum Cobalt Color Units, Prop. E.P.A. Std. 75 Units							
N. Fk. Kentucky River at Hazard	131	8	8.4	50	0	10-62	4-74
Red River at Pine Ridge	10	9	11	40	3	3-74	4-74
	46	15	14	70	0	4-69	11-74
	13	11	7.5	30	0	1-73	11-74
Ky. River, Lock 4 at Frankfort	138	9	7.8	50	0	10-59	10-72
Eagle Creek at Glencoe	45	51	65	300	0	1-62	11-74
	20	61	88	300	0	2-73	11-74
Sodium mg/l, No Standard							
N. Fk. Kentucky R. at Hazard	19	95	160	570	0.5	7-65	4-74
Red River at Pine Ridge	50	3	2	14	1.4	4-69	11-74
	18	4	3	14	1.4	1-73	11-74
Ky. River, Lock 4 at Frankfort	17	20	18	56	4.1	10-59	10-72
Eagle Creek at Glencoe	48	5	2	9.1	0.8	1-62	11-74
	23	5	2.2	9.1	0.8	2-73	11-74
Potassium mg/l, No Standard							
N. Fk. Kentucky River at Hazard	16	7.5	7.7	29	0.9	7-65	4-74
Red River at Pine Ridge	50	1.9	0.7	3.8	0.8	4-69	11-74
	18	1.9	0.8	3.6	0.8	1-73	11-74
Ky. River, Lock 4 at Frankfort	17	2.6	0.8	4.6	1.6	10-59	10-72
	4	2.1	0.7	2.9	1.4	4-73	10-74
Eagle Creek at Glencoe	48	3.2	1.2	5.8	1.1	1-62	11-74
	23	3.2	1.4	5.8	1.1	2-73	11-74
Chloride mg/l, Prop. E.P.A. Std. 250 mg/l							
N. Fk. Kentucky River at Hazard	267	19	91	1,000	0	10-62	4-74
Red River at Pine Ridge	30	104	260	1,000	1.5	1-73	4-74
	50	4	1.9	8	1.1	4-69	11-74
	18	4	1.9	7.6	1.1	1-73	11-74
Ky. River, Lock 4 at Frankfort	272	20	23	130	1.9	10-59	9-73
	14	9	5.4	20	2.6	1-73	9-73

Table H-9

Station	#Obs.	Mean	S	Max.	Min.	Beg. Date	End Date
Eagle Creek at Glencoe	49	8	11	80	1	1-62	11-74
	23	6	2.8	10	1.9	2-73	11-74
Sulfate mg/l, Prop. E.P.A. Std. 250 mg/l							
N. Fk. Kentucky River at Hazard	268	146	99	646	0.9	10-62	6-74
	32	87	84	410	0.9	1-73	6-74
Red River at Pine Ridge	55	16	5.6	43	7.9	4-69	11-74
	21	17	8.2	43	7.9	1-73	11-74
Ky. River, Lock 4 at Frankfort	272	34	13	89	13	10-59	9-73
	14	36	10	57	22	1-73	9-73
Eagle Creek at Glencoe	49	43	20	100	0.3	1-62	11-74
	23	46	25	100	0.3	2-73	11-74
Nitrate - N mg/l, Prop. E.P.A. Std. 10 mg/l							
N. Fk. Kentucky River at Hazard	43	0.6	0.7	4	0	4-72	4-74
Red River at Pine Ridge	15	0.2	0.1	0.5	0.02	6-72	8-74
Ky. River, Lock 4 at Frankfort	34	0.7	0.2	1.1	0.4	4-72	9-73
	14	0.7	0.2	1.1	0.4	1-73	9-73
Eagle Creek at Glencoe	18	0.4	0.3	0.8	0	10-72	7-74
Fluoride mg/l, Prop. E.P.A. Std. 10 mg/l							
N. Fk. Kentucky River at Hazard	28	0.6	0.8	3.7	0.1	10-68	4-74
Red River at Pine Ridge	50	0.2	0.3	2	0	4-69	11-74
	18	0.2	0.5	2	0	1-73	11-74
Ky. River, Lock 4 at Frankfort	18	0.2	0.1	0.4	0.1	10-59	10-72
	54	0.6	1.3	0.9	0.1	1-70	11-74
Eagle Creek at Glencoe	49	0.3	0.2	1.1	0.1	1-62	11-74
	23	0.2	0.1	0.5	0.1	2-73	11-74
Kentucky R. at Lexington	53	0.4	0.3	0.9	0	3-69	11-74
Calcium - Micrograms per liter (ug/l) No Std.							
N. Fk. Kentucky River at Hazard	15	50	37	131	1.3	10-68	4-74
Red River at Pine Ridge	50	12	10	57	3.5	4-69	11-74
	18	16	16	57	3.5	1-73	11-74
Kentucky River, Lock 4 at Frankfort	19	37	11	57	21	10-59	10-72
Eagle Creek at Glencoe	48	58	20	88	2.7	1-62	11-74
	23	58	25	88	2.7	2-73	11-74

Table H-9

Station	#Obs.	Mean	S	Max.	Min.	Beg. Date	End Date
Magnesium mg/l, No Standard							
N. Fk. Ky. River at Hazard	15	28	31.3	110	0.4	10-68	4-74
Red River at Pine Ridge	50	4	3.0	23	2.0	4-69	11-74
	18	4.8	4.9	23	2.0	1-73	11-74
Ky. River, Lock 4 at Frankfort	19	7.5	3.4	14	3.1	10-59	10-72
Eagle Creek at Glencoe	48	8.4	4.0	20	0.4	1-62	11-74
	23	9.1	5.0	20	0.4	2-73	11-74
Cadmium ug/l, micrograms per liter, Ky Std. 100 ug/l							
N. Fk. Kentucky River at Hazard	12	0.3	1.2	4	0	10-63	6-74
	6	0.7	1.6	4	0	4-74	6-74
Ky. River, Lock 4 at Glencoe	13	0	0	0	0	11-62	6-74
	54	1	0.9	5	0	1-70	11-74
Eagle Creek at Glencoe	4	1.8	2.1	4	0	3-74	6-74
Ky. River at Lexington	53	0.6	0.5	1	0	3-69	11-74
Manganese ug/l, micrograms per liter, Prop. Std. 50 ug/l							
N. Fk. Kentucky River at Hazard	5	32	31	83	0	4-74	4-74
Red River at Pine Ridge	26	26	21	67	0	10-71	11-74
Eagle Creek at Glencoe	29	29	36	180	0	10-71	11-74
Iron ug/l, micrograms per liter, E.P.A. Std. 300 ug/l							
N. Fk. Kentucky River at Hazard	32	199	426	1,800	0	12-64	4-74
	11	434	666	1,800	10	3-74	4-74
Red River at Pine Ridge	27	154	118	480	0	10-71	11-74
Ky. River, Lock 4 at Frankfort	71	45	62	320	0	10-60	9-65
Eagle Creek at Glencoe	31	96	75	280	0	10-71	11-74
Chromium ug/l, micrograms per liter, Ky. Std. 50 ug/l							
N. Fk. Ky. River at Hazard	6	1.7	4.1	10	0	4-74	6-74
Ky. River, Lock 4 at Frankfort	52	1.5	1.6	7	0	1-70	11-74
Eagle Creek at Glencoe	4	0.3	0.5	1	0	3-74	6-74
Ky. River at Lexington	53	1.5	1.5	6	0	3-69	11-74
Lead ug/l, micrograms per liter, Ky. Std. 50 ug/l							
N. Fk. Ky. R. at Hazard	11	1.6	4.2	14	0	10-63	4-74
Ky. R., Lock 4 at Frankfort	13	1.4	3.2	9	0	11-62	6-74
	50	8.4	5.5	34	1	1-70	11-74
Eagle Creek at Glencoe	4	8	16	32	0	3-74	6-74
Ky. River at Lexington	48	8.3	5	29	1	3-69	11-74

Table H-9

Station	#Obs.	Mean	S	Max.	Min.	Beg. Date	End Date
Silver ug/l, micrograms per liter, Ky. Std. 50 ug/l							
Ky. River, Lock 4 at Frankfort	54	0.6	0.6	3	0	1-70	11-74
Kentucky River at Lexington	53	0.5	0.6	2	0	3-69	11-74
Arsenic ug/l, micrograms per liter, Ky. Std. 50 ug/l							
N. Fk. Kentucky River at Hazard	12 6	0.3 0.7	0.8 1	2 2	0 0	10-63 4-74	6-74 6-74
Ky. River, Lock 4 at Frankfort	14 14	1.1 0.5	3.3 0.5	12 1	0 0	11-62 1-71	6-74 4-74
Eagle Creek at Glencoe	4	1	1.2	2	0	3-74	6-74
Kentucky River at Lexington	13	0.7	1.1	1	0	7-71	4-74

#Obs: Total number of observations in period shown.

S: Standard Deviation

THE LICKING RIVER BASIN

This report is in three parts. The first is a general basin description, the second describes the water quality, and the third part summarizes the problems and offers some general solutions.

I. A Description of the Licking River Basin

A. Geography

The Licking River Basin is located entirely within the eastern portion of the Commonwealth of Kentucky. The Licking River rises in southeastern Kentucky and flows northwesterly to its confluence with the Ohio River, opposite Cincinnati, Ohio. The total drainage area of the basin is 3,700 sq. mi. which is approximately 9 per cent of the land area of the state and includes all or portions of 21 counties. The basin is shaped much like an elongated diamond with an axis of about 130 miles and a minor axis of about 60 miles. The main stem is approximately 320 miles long.

The basin extends from Covington and Newport, Kentucky in the north, to below Salyersville in the south and from beyond Flemingsburg and Morehead in the east to Winchester in the west.

B. Topography

The Licking River drainage area is entirely south of the glaciated portion of the Ohio River Basin and physical features of the basin are generally the result of geological strata exposed by differential erosion following the broad uplift of the Paleozoic Era known as the Cincinnati Arch. The Licking River Basin exhibits four distinct physiographic types. The river rises in the Eastern Coal Fields of the Kanawha section of the (1) Appalachian Plateau, which has narrow ridges and crooked steep sided valleys. It flows through the (2) Knobs and the (3) Outer Blue Grass Regions. The South Fork

drains a portion of the (4) Inner Blue Grass region of the Interior Low Plateau.

The Knobs is an area of conical hills with rather broad valleys. The Outer Blue Grass is rather gently rolling except where the streams have entrenched themselves into deep valleys. The Inner Blue Grass region is gently rolling upland. There are no natural lakes in the basin. The generally flat topography of the Licking River Basin allows little reaeration due to the slope of the streams. Reaeration is the replacement of dissolved oxygen from the atmosphere which was used to stabilize organic matter. The river courses from an elevation of 998 ft. mean sea level (m.s.l.) at its headwaters to an elevation of 420 ft. m.s.l. at the confluence with the Ohio River for some 320 miles. The main stem has an average slope of approximately 1.9 ft./mi. Over the low half of the river the average slope is 1.3 ft./mi. The slopes of the tributaries average between 1 to 2 ft./mi. for the North and South Forks and into the hundreds of feet per mile in some of the smaller tributaries. A slope in the range of 0 to 2 ft./mi. is considered low, 2 to 6 ft./mi. is moderate and 6 to 10 ft./mi. is high as it relates to the effect of reaeration.

C. Geology

The major geologic influence on the quality of the water in the Licking River Basin is the occurrence of limestone throughout the basin. Limestone contributes calcium and magnesium through solution from the soil and rocks which imparts hardness to the water. The coal field does not appear to be having a significant effect on water quality at this time.

The groundwater resources are limited by the low yield of the aquifers in the basin, thus restricting the use of groundwater as a major source of water supply.

D. Hydrology

During the late summer and early autumn portions of the Licking River have flows of less than 5 cubic feet per second (Table I-2). Such low flows severely limit the capacity of a stream to maintain the standard of 5 mg/l of dissolved oxygen. Cave Run Reservoir near Farmers, Kentucky, 174 miles from the mouth, was built to store 47,000 acre feet of water for flood control, water supply recreation and low flow augmentation. Cave Run Reservoir is designed to augment the low flow in the Licking River by 50 cubic feet per second (c.f.s.).

Table I-2
Surface Flow in the Licking River Basin

Station	Period of Record	Drainage Area	Average Flow	Maximum Flow	Minimum Flow	7 Day 10 Yr. Low Flow
Licking River at Farmers, Kentucky	36 yr.	827 sq. mi.	1,060 cfs, $\frac{1.3 \text{ cfs}}{\text{sq. mi.}}$	24,000 cfs, $\frac{29 \text{ cfs}}{\text{sq. mi.}}$	0.7 cfs, $\frac{0.0 \text{ cfs}}{\text{sq. mi.}}$	54.4 cfs
South Fork Licking River at Cynthiana, Kentucky	36 yr.	621 sq. mi.	754 cfs, $\frac{1.2 \text{ cfs}}{\text{sq. mi.}}$	35,300 cfs, $\frac{56.8 \text{ cfs}}{\text{sq. mi.}}$	0.3 cfs, $\frac{0.0 \text{ cfs}}{\text{sq. mi.}}$.9 cfs
Licking River at Catawba, Kentucky	48 yr.	3,300 sq. mi.	4,119 cfs, $\frac{1.2 \text{ cfs}}{\text{sq. mi.}}$	95,000 cfs, $\frac{28.8 \text{ cfs}}{\text{sq. mi.}}$	2.5 cfs, $\frac{0.0 \text{ cfs}}{\text{sq. mi.}}$	62 cfs

Information is from the "Surface Water Records" published by the United States Geological Survey. The 7-day - 10-year low flow information was taken from the Waste Load Allocation, a part of the Kentucky 303e River Basin Continuing Planning Process.

E. Population

The population of the Licking River Basin was 211,000 in 1970. The distribution throughout the basin is fairly uniform except for a major population center in Campbell and Kenton Counties, composing a part of the SMSA of Cincinnati, Ohio. Although Campbell and Kenton Counties don't discharge treated sewage into the Licking River, combined sewer overflow and street run-off do affect water quality in the lower Licking River. The total urban population of the basin is 106,000 or 50 per cent of the whole basin. The other 50 per cent is in rural areas.

II. Basin Water Quality

The water quality of the Licking River Basin has been determined by using both a computer model and data collected at three monitoring stations. These sources give an overall picture of the basin which shows problems caused by sewage treatment plant effluent and erosion.

A. Description of Sampling Stations

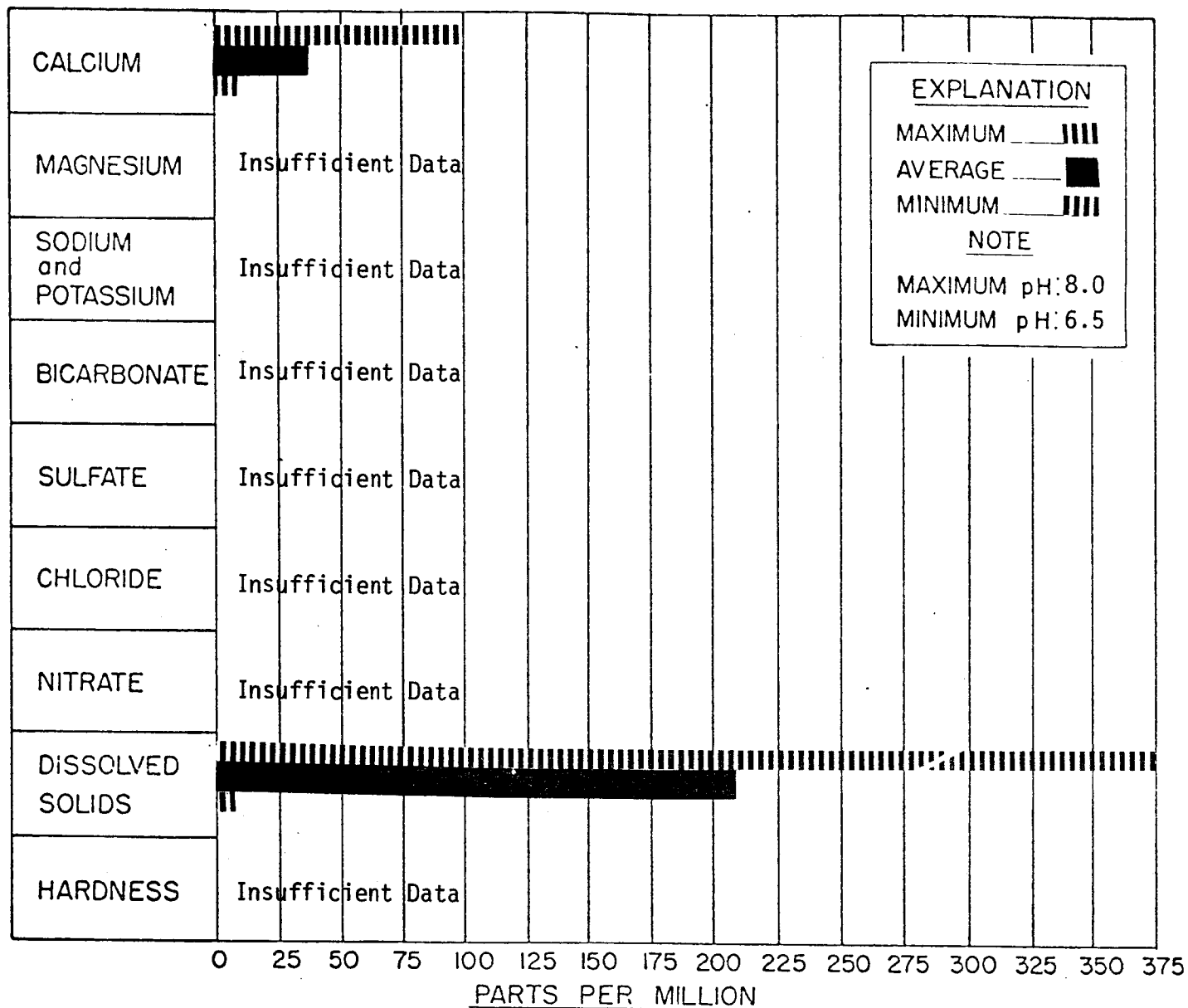
The Salyersville monitoring station, the farthest upstream of the three stations, is on the Licking River 1.2 miles west of Salyersville and 266 miles from the mouth. The drainage area at this point is 140 sq. mi.

The second station, at McKinneysburg, on the Licking River is 64 miles from the mouth and has a drainage area of 2,300 sq. mi.

The last station is at the Kenton County water intake on the Licking River approximately 2 miles from the mouth at the Ohio River. The drainage area at this station is approximately 3,700 sq. mi.

B. General Chemical Water Quality

The chemical composition of water is best defined by grouping dissolved elements which compose the total dissolved solids. By examining the relationships of groups of chemicals, the type of water whether hard or soft, salty, acid or high in sulfates reflects the mix of surface and groundwater. The chemical characteristics of a stream when viewed over a long period of time is primarily from surface water. The type of rock formation and soils which the surface water contacts causes this predominate chemical characteristic. The contribution of groundwater, which is generally higher in dissolved solids than surface water, can be shown by selecting the low flow period for data analyses. The general character of waters in Kentucky is of moderate hardness caused by calcium and magnesium salts. The influence of mining activities are clearly indicated when the sulfate content increases to a higher level than the bicarbonate content, and the pH is on the acid side, below pH 5.5.



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,
 Licking River at Salyersville -

Period of Record: 1-73 to 11-74

Figure I-1

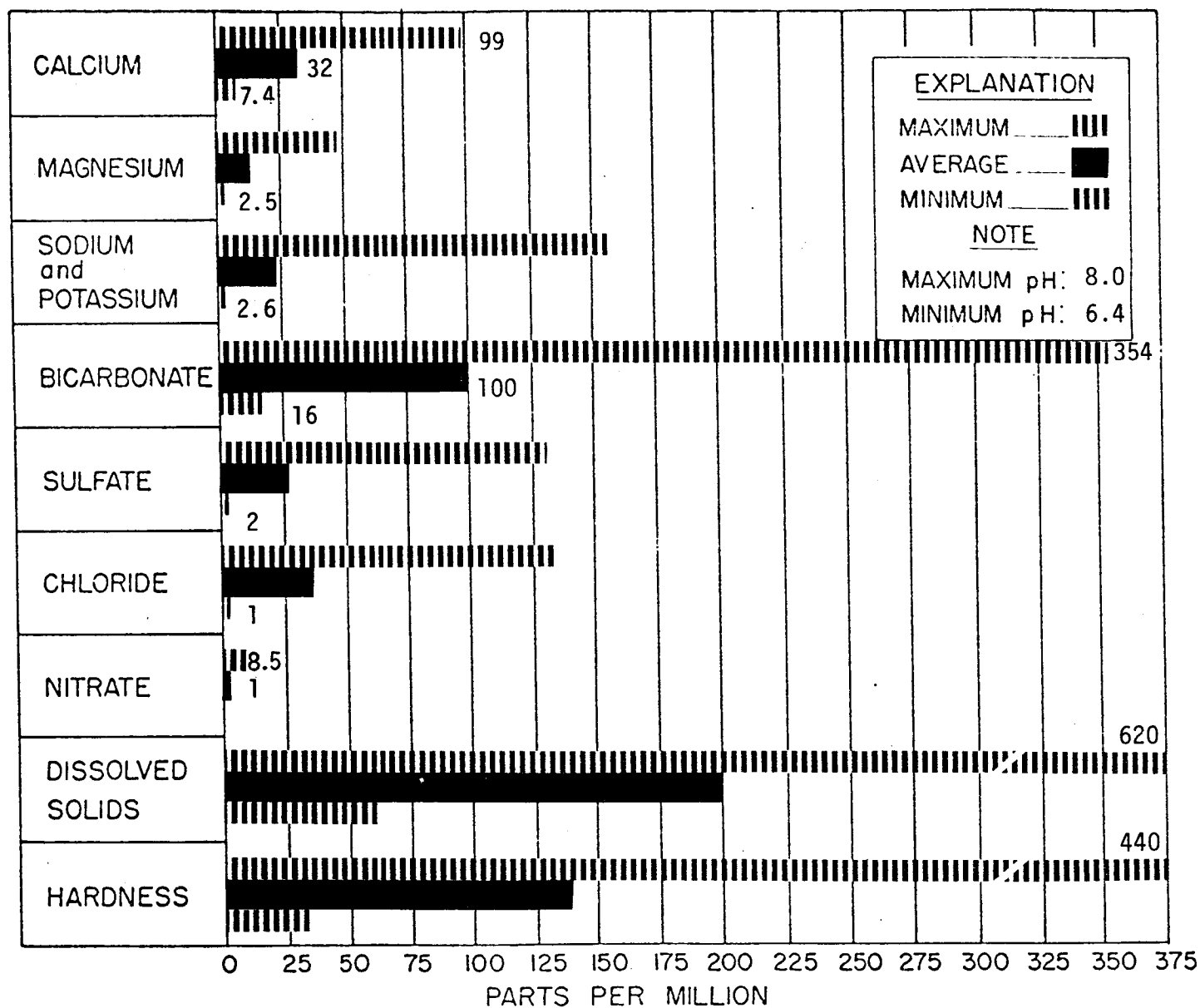
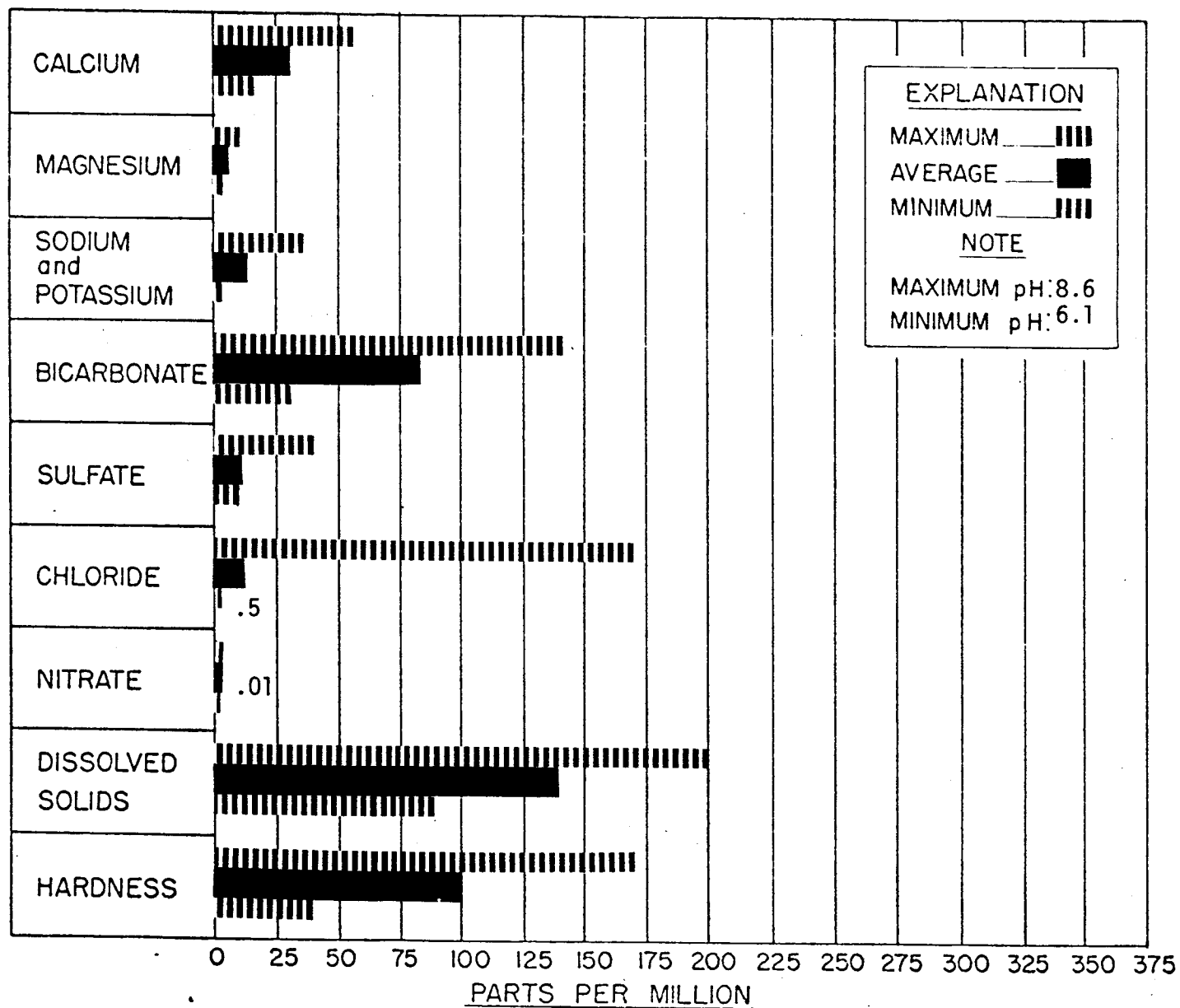


Figure I-2

MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,

Licking River at Salyersville

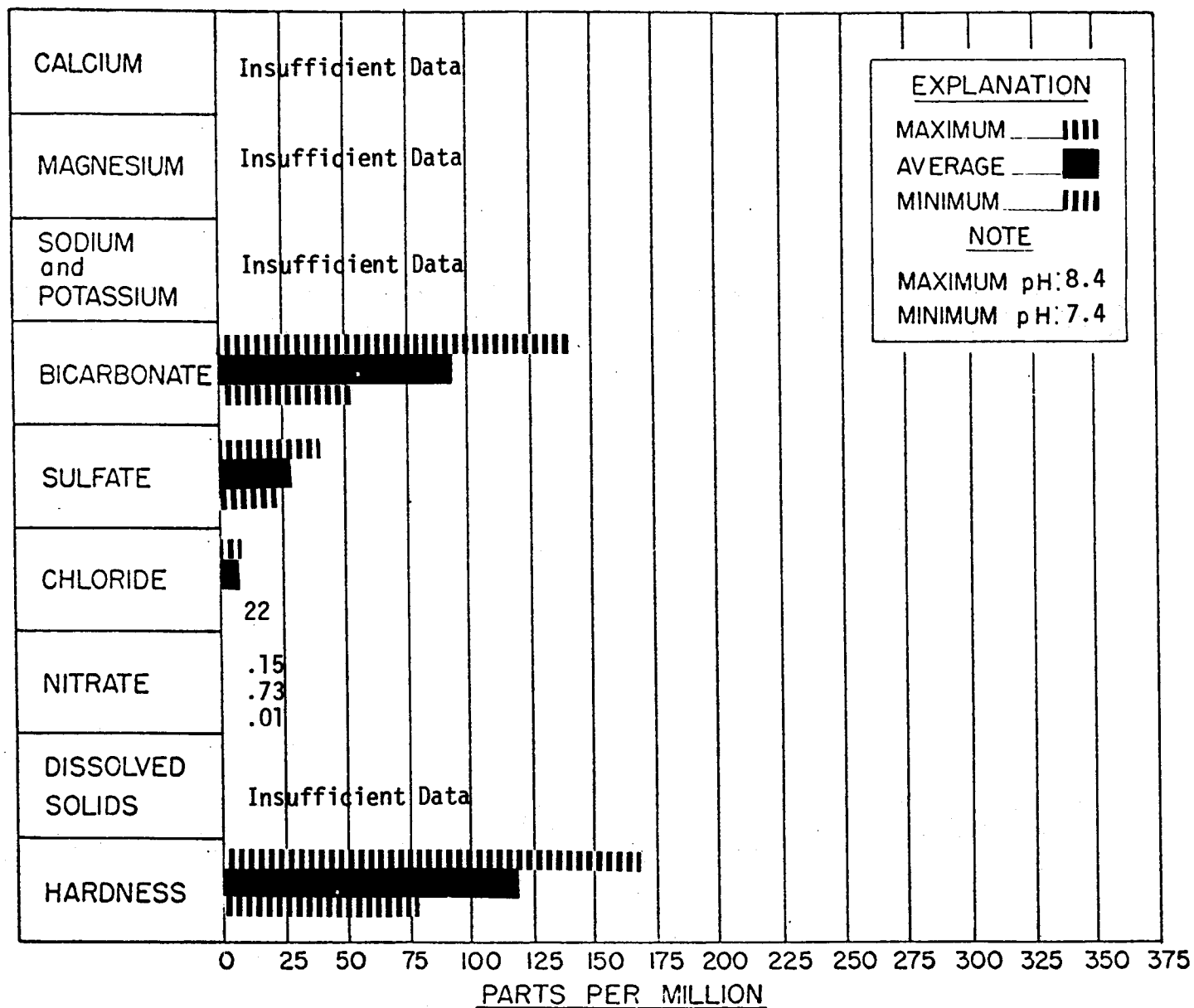
Period of Record 5-65 to 11-74



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,
 Licking River at McKinneysburg.

Period of Record 10-59 to 10-73

Figure I-3



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,

Licking River at McKinneysburg

Period of Record: 1-73 to 10-73

Figure I-4

Oil field operations, when brine is encountered, are reflected by changes in sodium and chloride contents of the water. For Kentucky water, the influence is pronounced when either chloride or sodium exceeds 20-25 parts per million as an average value.

The two sampling stations were used to depict the general chemical water quality for the Licking River basin reflect two different situations on the river.

Salyersville was selected to determine the effect of coal mining on water quality. This station is near the headwaters and above Cave Run Reservoir, and shows a wide variation in chemical quality partly due to the relatively small drainage area. That area is totally within the eastern coal field and fluctuations at the Salyersville station indicate the effects of coal mining and oil field operations on water quality. The effect of coal mining and oil field productions is illustrated principally in Figure I-2. The extreme variation in all parameters in comparing the average to the maximum indicates the influence of sporadic discharges which impacts water quality primarily at low flow periods. The production of coal in the Licking River Basin is low as compared to the coal reserves. Oil field production is primarily limited to recharged well production which is limited. Both of these developments reflect the primary influence of water quality, particularly at times of low flow. Since the average values are much as would be expected without oil or coal production. Figure I-2 indicates that the water is approximately an average type water when looking at the average values.

McKinneysburg, the other station was selected to indicate general chemical water quality, of the majority of the drainage basin (62%) and the effects of Cave Run Reservoir.

The water is classified as soft, moderately hard, hard, and very hard due to the concentration of certain ions, primarily calcium and magnesium. The range of hardness is 121 mg/l + 180 mg/l with an average of 136 which is a hard water.

The impact on water quality from Cave Run Reservoir at McKinneysburg is clearly illustrated by comparing the graphs of McKinneysburg and Salyersville. All parameters decrease at McKinneysburg which demonstrates the effectiveness of water reservoir impoundments for quality control of the general chemical quality of water and the ability of a reservoir to iron out or stabilize imparted chemical quality from the exploration of mineral resources such as coal and iron field developments.

C. Trace Chemical Water Quality

Trace elements (under 5 mg/l) are separated from the general chemical background of this report because of their influence on human health. Generally, these materials are "heavy" metals, which in sufficient concentrations have a toxic or otherwise adverse effect on human and animal or plant life. Levels for many of these elements have been established for years in the Drinking Water Standards and more recently through the State-Federal Water Quality Standards.

The trace chemicals results were from samplings at the Kenton County water district and in the Licking River Basin the water quality falls within the Kentucky-Federal Water Quality Standards.

D. Waste Load Effects on Water Quality

Biochemical degradable waste impost a load on the dissolved oxygen resources of a stream. Such waste loads are considered to have an adverse effect on water quality when they cause the dissolved oxygen concentration of the water to drop below the Kentucky water quality standard of 5.0 mg/l. Approximately 1,000 miles of stream length were studied using a model to determine waste load allocations. The model was developed in the Kentucky Continuing Planning process for River Basin Management Planning. Using this model it was determined that approximately 384 miles are affected by treated wastewater. Of the 384 miles 51 miles are affected by industry, 90 miles by municipal sewage treatment plants and 243 miles are affected by other sources such as schools, trailer parks, motels, etc.